Hemostasis in endoscopic endonasal skull base surgery using the Aquamantys bipolar sealer: Technical note

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ABSTRACT

Background: A major challenge during endoscopic transsphenoidal surgery is adequate intraoperative hemostasis. The Aquamantys® is a relatively new bipolar sealing device which uses radiofrequency energy and saline. This promotes hemostasis while decreasing charring and thermal spread. In this paper, we describe our experience with the Aquamantys® Mini EVS 3.4 Epidural Vein Sealer Bipolar Electrocautery System (Medtronic Advanced Energy, Portsmouth, NH, USA) during endoscopic surgery for tumors of the skull base with particular attention to ergonomic benefits and technical nuances.
Methods: We conducted a retrospective review of all patients undergoing endoscopic surgery for skull base tumors from September 2012 to June 2016 at our institution. All procedures used the Aquamantys® system. 45 cases were identified.
Results: Successful hemostasis was achieved in all cases with an average estimated blood loss (EBL) of 46 mL (Range 10–250). There were no intraoperative complications. The single-shaft design allowed for excellent manipulation compared to pistol-grip bipolar forceps. The thermal energy provided excellent radial coverage without extensive penetration into viable pituitary tissue.
Conclusion: To our knowledge, this is the largest series documenting the use of the Aquamantys® system in skull base surgery. The device is easily mobile and highly effective within the endonasal corridor and should be a tool in the repertoire of the endoneurosurgeon. Randomized control trials would be useful in comparing EBL between the Aquamantys® and standard bipolar electrocautery.

1. Introduction

With the advent of minimally invasive neurosurgical techniques, endoscopic transsphenoidal surgery via the nasal or sublabial route has become the cornerstone in treating tumors of the skull base. The endoscopic transsphenoidal approach (TSA) has been shown to be effective in terms of safety and tumor resection when compared to traditional microscope-assisted surgery [8]. Complication rates for endoscopic skull base surgery are reported to occur in less than 10% of patients with perioperative mortality at 0.24% [10]. Nevertheless, a variety of complications exist for the TSA. Operating in a narrow corridor with limited visualization and delicate surrounding vasculature demands that the most effective methods of hemostasis be in place.

A variety of hemostatic methods are currently used and include preoperative embolization, gentle pressure, monopolar electrocautery, bipolar electrocautery, bone wax, gelfoam sponges, and several clot-forming agents among others. Bipolar electrocautery is regarded as the most important tool for the endoneurosurgeon [6]. The Aquamantys® System provides hemostasis by combining a bipolar electrosurgical generator with a rotary peristaltic pump, the latter of which provides saline irrigation [3]. This functions to cool tissue while evenly conducting energy over the entire surface area. The saline prevents temperatures from exceeding 100 °C, which is well below the near-300 °C temperature encountered in standard electrocautery. The bipolar sealer shrinks type I and III collagen within blood vessels without charring, burning, or significant smoke production [1].

This device has been previously used in abdominal, orthopedic, and neurosurgical procedures with proven efficacy when compared to standard bipolar cautery [5,7,9,12]. However, there remains a paucity of data describing it's use in cranial surgery. Over the past 4 years, we have been successfully using the Aquamantys® Epidural Vein Sealer when operating on a variety of tumors of the cranial base with excellent results.

2. Materials and methods

A retrospective review of patients undergoing endoscopic surgery for skull base tumors from September 2012 to June 2016 was performed. All procedures used the Aquamantys® Mini EVS 3.4 Epidural Vein Sealer. We identified 43 patients representing a total of 45 cases. Two of the 43 patients underwent both an initial surgery and reoperation for recurrent disease. The Aquamantys® system was used for both the initial and repeat operations in these patients.

2.1. Surgical technique

Prior to the endoscopic portion of the procedure, a lumbar drain is placed. All patients have a septoplasty performed in order to obtain greater visualization and navigation into the sphenoid sinus. Both bony and cartilaginous segments of the septum are resected, with a portion of cartilage harvested for later use during sella repair. The rostrum of the sphenoid is removed and the natural ostia are identified. Bony tissue between the ostia is resected, allowing for identification and entrance into the sella turcica. At this point the dura mater becomes visible and the Epidural Vein Sealer (EVS) is utilized to cauterize the epidural veins. A coagula-

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Table 1
Demographic and clinical data.

Age (yrs)	49 ± 17
Gender (male/female)	24/21
BMI (kg/m^2)	29 ± 4.5
LOS (days)	4 ± 3
Tumor type	
Pituitary adenoma	40
Craniopharyngioma	3
Rathke's cleft cyst	2
Tumor size* (cm)	1.9 ± .77 × 2.0 ± .68
EBL (mL)	46 ± 30
Reoperations	10
Intraoperative complications	0
Postoperative complications	2
Anemia requiring transfusion	1
Subdural hematoma	1

* Dimensions reported as craniocaudal X transverse.

tion setting of 60 W and flow rate setting of medium is used. The device is able to successfully reach the dura mater and is easily maneuverable at the skull base.

Once the EVS has sufficiently desiccated the epidural vessels, the dura mater is incised in a cruciate manner, allowing for removal of the tumor. Image guided localization systems such as BrainLAB® (BrainLAB AG, Munich, Germany) are useful during this portion of the procedure. After tumor resection and frozen section pathology, a layered closure is performed with Durepair® dura regeneration matrix (Medtronic, Minneapolis, Minn., USA). The harvested septal cartilage can then be placed superficial to the dura mater. Finally, Tisseel® Fibrin sealant (Baxter Healthcare Corp., Deerfield, IL) is used to seal the mucosal flap over the remaining defect.

3. Results

Table 1 provides a summary of the demographic and clinical data of the cohort. The mean age was 49 years (range 12–79) and approximately 47% of patients were female (21/45). The average estimated blood loss (EBL) and length of stay (LOS) was 46 mL (range 10–250) and four days (range 1–15) respectively. Septal dissection was noted to contribute more to overall blood loss than tumor resection. Several tumor types were encountered, the most common of which was a pituitary adenoma. This included both secretory and non-secretory adenomas. 10 cases represented reoperations for recurrent tumors. There were no intraoperative complications.

There were a total of two postoperative complications involving two patients. One patient experienced an acute right hemispheric

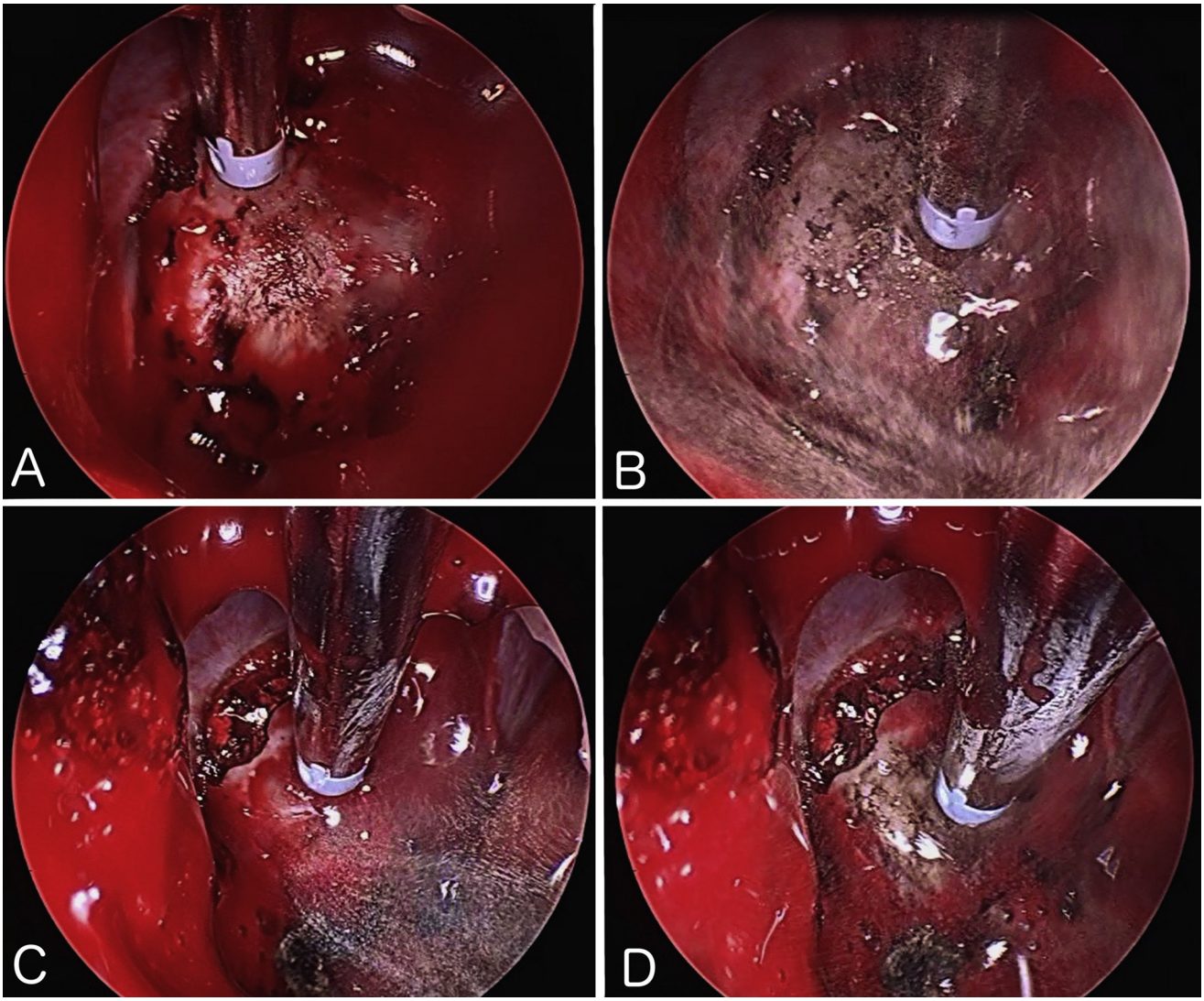

Fig. 1. Endoscopic intraoperative view showing exposure of the dura after resection of the posterior nasal septum, removal of the sphenoidal rostrum, and subsequent sella take-down (A and C). Aquamantys® Mini EVS 3.4 Epidural Vein Sealer is shown cauterizing the epidural veins (B and D).